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and needs no introduction to the scientific world.

Beaufort is situated near one of the great ocean inlets, and the waters of the harbor and adjacent sounds are remarkably well supplied with fishes and invertebrates. The advantages this locality affords for biological research are well known, as many naturalists have from time to time resorted thereto for the study of special problems.

In the early fall Beaufort will be made the headquarters of the steamer *Fish-Hawk* during a biological and topographical survey of the oyster grounds of the State which the Commission will conduct at the request of Professor J. A. Holmes, director of the North Carolina Natural History and Geological Survey, and other State officials.

HUGH M. SMITH.

U. S. COMMISSION OF  
FISH AND FISHERIES.

#### THEORY OF THE STEAM ENGINE.

M. NADAL, in a very extended review of the recognized 'Principles of the Mathematical Theory of the Steam Engine,' in recent issues of the *Revue de Mécanique*, discusses the theory of heat-exchanges between working fluid and cylinder-walls, the influence of the duration of the admission period, that of the compression and of the velocity of operation of the motor; touching upon the experimental work of Dwelshauvers-Dery. His principal conclusions are the following: \*

1. The absorptive power of the metal in contact with the vapor is finite, and variable as a function of time. It is more considerable than the emissive power. The variation of this absorbing power is a function of the amount of liquid deposited upon the wall, and that amount has been shown by Donkin to vary, in the cases reported by him, from 20 calories per square meter per unit difference of temperature between metal and vapor, per second, and, at the time of admission, down to 12 during expansion and lower, and to 2 during the period of re evaporation and of emission, and to even less values as exhaust becomes complete; although this re-evaporation may be

\* *Revue de Mécanique*, 1898-9.

exceedingly rapid at the moment of opening the eduction port.

2. In the case of the unjacketed cylinder the mean temperature of the wall is equal or superior to that of the vapor in contact with it.

3. The heat surrendered by the vapor at induction increases less rapidly than does the period of action, that of induction. The indications are that the range of temperature during expansion mainly affects the quantity of the heat-exchange and that the total temperature-range does not measure the waste, which is contrary to general opinion among engineers and physicists.

4. Compression in the clearance or 'dead spaces' is not always advantageous.

M. Nadal shows that the moisture on the wall plays an important part, augmenting the quantity of heat-waste as superheating diminishes it. It is found that the variation of the magnitude of heat-exchanges during the forward and the return stroke accounts largely for the well-established, and often large, gains due to the use of the steam-jacket; since that accessory may communicate heat rapidly and effectively during the earlier portion of the cycle, while the sluggish transfer of heat out of the cylinder wall during the period of low pressure and temperature checks the wastes that would otherwise then occur, and more extensively than in the earlier period. Thus this variation of transferring power of the wall acts as a sort of 'check-valve' for the heat received from the jacket, permitting it to act efficiently, where most needed and preventing loss of heat where its transfer could do no good and would be purely a waste. Thus the jacket, also, is most economical in those engines which would be most economical without it, those in which the interior walls of the cylinder are dry during exhaust.

R. H. THURSTON.

#### THE PHILADELPHIA EXPOSITION OF 1900.

We have received from the officers of the Philadelphia Exposition of 1900 details in regard to their plans. It is their purpose to exhibit every kind of manufactured products of the United States especially suitable for export. Such exhibits will form the principal depart-

ment of the Exposition and will comprise everything which is, can or might be exported, from locomotives and heavy machinery to the smallest novelties.

There will also be a department of foreign manufactured goods, but it will not contain a single exhibit shown by a foreign manufacturer. This department will consist of collections of samples of goods made in the commercial countries of Europe and successfully sold in all foreign markets in competition with American goods and in foreign markets in which American trade has not yet been developed. These samples will be exhibited side by side with American products of the same class, and will show our manufacturers just what competition they must meet abroad, as well as the peculiarities in the demands of every foreign market.

A third department of the Exposition will show how American goods must be packed, labeled and shipped in order to meet the requirements of foreign trade, which vary according to the degree of development or civilization in each country of the world.

In October a Commercial Congress will be held in Philadelphia in connection with the meeting of the International Advisory Board of the Philadelphia Commercial Museums. There is every reason to believe that at least 800 representatives of foreign firms will be present at the sessions of the Commercial Congress and in attendance on the Exposition, in addition to the official delegates and those representing commercial organizations.

The Exposition will be under the joint auspices of the Philadelphia Commercial Museums and the Franklin Institute. Sanction and support has been given to the Exposition by the National Government, Congress appropriating \$350,000 to aid it. The City of Philadelphia has given \$200,000, and the State of Pennsylvania \$50,000, and \$100,000 is being raised in Philadelphia by individual subscriptions.

The main buildings, which are now under construction, cover eight acres of ground, and the available exhibition space will be at least 200,000 square feet. Outside of the space occupied by the main buildings there will be within

the Exposition grounds, which comprise a tract of fifty-six acres of land on the bank of the Schuylkill River, within fifteen minutes' ride of the City Hall, ample space for the erection of detached structures for special exhibits.

#### SCIENTIFIC NOTES AND NEWS.

VICE-PRESIDENT BRANNER, of Stanford University, will conduct an expedition to Brazil during the summer to work upon the geology of the stone and coral reefs of the coast. These reefs, more or less broken, extend from Ceará to the Abrolhos, a distance of more than a thousand miles. Dr. Branner did much work upon these reefs while he was connected with the Geological Survey of Brazil, but the field observations were never finished and the results of the work were not published. He hopes to complete his work during the summer vacation. The expenses of the expedition will be paid chiefly by Professor Alexander Agassiz, and the results will be published by the Museum of Comparative Zoology at Harvard.

PRINCETON proposes to send a small party to observe the total eclipse of the sun which is to occur on May 27, 1900. A friend of the University has provided the necessary funds, and the special apparatus that will be needed is already being constructed. The station to be occupied is not yet finally selected, but will probably be near the boundary between North and South Carolina, where it is crossed by the track of the moon's shadow, running northeastward from New Orleans to Norfolk, Va.

THE Iron and Steel Institute of Great Britain has conferred the Bessemer Gold Medal for 1899 on Queen Victoria in commemoration of the great progress made in the iron and steel industries during her Majesty's reign.

THE Academy of Sciences at Halle has elected Dr. Hans Lenck, professor of mineralogy at Erlangen, to membership.

SIR JAMES WRIGHT, C.B., late Engineer-in-Chief of the British Navy, to whom many of the improvements in British warships are due, died on April 16th in his 86th year.

THE death is also announced of Sir William Roberts, F.R.S., the eminent London physician,